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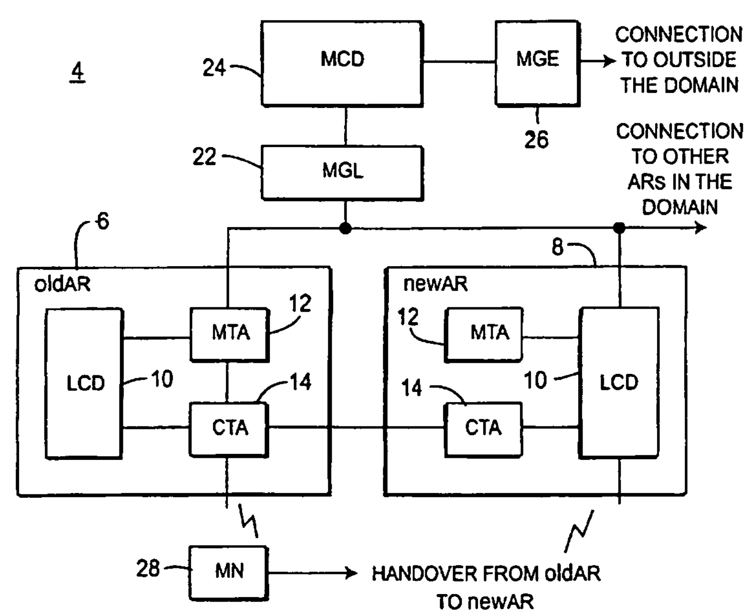
(54) Title: SYSTEM FOR CONTEXT TRANSFER FOR WIRELESS INTERNET DEVICES



(57) Abstract: A system (Fig. 1) and method for storing features/QoS parameters in a main/central database (MCD, 24 Fig. 1) and also in a local context directory (10). A memory transfer agent (12) is used to transfer only active feature contexts from a first router (6) to a new router (8) during handover.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

[0001] SYSTEM FOR CONTEXT TRANSFER FOR WIRELESS INTERNET DEVICES

[0002] FIELD OF INVENTION

[0003] The present invention relates to the field of communications. More specifically, the present invention relates to supporting microflows by the mobile Internet, and to a context transfer approach to supporting microflows.

[0004] BACKGROUND

[0005] The Internet is increasingly being used to support mobile applications. There a growing need to support many different types of microflows, including both real-time and non real-time services.

[0006] In a mobile environment, microflows emanating from a Mobile Node (MN) are characterized by a set of parameters. The parameters define a context and the resulting feature contexts may be stored within an access router (AR).

[0007] Some features are specifically defined for a particular microflow, while others are defined for all the microflows belonging to the MN. These features may be for defining the QoS state, (such as RSVP, DiffServ, COPS), maintaining robust header compression, (such as van Jacobson and GRE), and security, (such as PKI and AAA). In order to assist in preserving the network bandwidth, it is desirable to store these parameters at some node entity within the access network, instead of at the MN itself. By doing that, the overhead of processing and transmission delay from the MN to the AR is greatly reduced. This saves the transmission bandwidth through the radio link and makes the design of the MN much simpler.

[0008] The context transfer protocol is tightly integrated into the handover protocols currently developed by the IETF, such as: Fast Handovers for Mobile IPv6, Low Latency Handoffs in Mobile IPv4, and Bi-directional Edge Tunnel Handover for IPv6. It must support seamless (i.e. uninterrupted), loss-less, resumption of services after the handover is completed. Therefore, an essential requirement of context transfer is that

there must be good synchronization between the handover protocol and the context transfer method, and the context transfer must be reliable.

[0009] The protocol must maintain the integrity of data during the context transfer. There must be security association between the two ARs so that they can mutually authenticate themselves prior to the transfer of context. The context transfer protocol must also minimize the amount of processing at the sending and receiving ARs, and it must complete the context transfer with a minimum number of signaling messages.

[0010] It would also be desirable for the context transfer protocol to be scalable. Scalability means that the context transfer protocol should scale with the number of participating MNs, and that it should scale with the number of feature contexts and feature contexts being transferred.

[0011] SUMMARY

[0012] The present invention is a system and method which stores all currently "active" feature contexts locally at the ARs, and stores all "inactive" feature contexts centrally in a main database. The main database can be accessed by all the ARs within the same administrative domain. When a new microflow becomes active, its active feature contexts are brought from the main database and loaded into the local directory, thus replacing any inactive feature contexts that are not needed at the time.

[0013] BRIEF DESCRIPTION OF THE DRAWING(S)

[0014] Figure 1 is a block diagram of the architecture for performing context transfer between a pair of ARs.

[0015] Figure 2 depicts a context transfer L3 trigger message.

[0016] Figure 3 depicts a context transfer L3 acknowledgement message.

[0017] Figure 4 illustrates a ICMP Message Format for CTR, CTA and CTD.

[0018] Figure 5 depicts the format of feature context object(s) message.

[0019] Figure 6 illustrates format of a context transfer object.

[0020] Figure 7 depicts a context transfer ESP message format.

[0021] Figure 8 is a flow diagram of a method for feature context transfer.

[0022] Tables 1 and 2 provide an overview of the acronyms used in the figures relating to the entities and the signals, respectively.

ENTITIES	
ACRONYM	MEANING
LCD	Local Context Directory
CTA	Context Transfer Agent
MTA	Memory Transfer Agent
MN	Mobile Node
AR	Access Router
MCD	Main Context Database
MGL	Memory Gateway (local)
MGE	Memory Gateway (external)

TABLE 1

ENTITIES	
ACRONYM	MEANING
CTR	Context Transfer Request
CTA	Context Transfer Accept
CTD	Context Transfer Denied
CTINIT	Context Transfer Initiate
CTACK	Context Transfer Acknowledge
FCR	Feature Context Request
FCA	Feature Context Accept
FCD	Feature Context Denied

TABLE 2

[0023] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0024] The preferred embodiment will described with reference to the drawing figures wherein like numerals represent like elements throughout.

[0025] As an overview of the present invention, feature contexts are maintained within each AR for every MN that is connected to that AR. The feature contexts define the microflows of an MN. These feature contexts may be “active” or “inactive" depending on whether or not the MN needs to make use of it at that time. If at anytime during a session an MN wishes to initiate a handover from its current AR (hereinafter "oldAR") to a different AR

(hereinafter "newAR"), it sends a Context Transfer Initiate (CTINIT) message to the oldAR. This message may be in the form of a layer 2 (L2) trigger or it may be a special layer 3 (L3) packet. Included in the trigger message is the identity of the newAR to which the feature contexts are being transferred. After the oldAR has determined the identity of the newAR, it sends a Context Transfer Request (CTR) message to the newAR. The newAR may choose to accept or reject this request. If the CTR is accepted, the newAR sends back a Context Transfer Accepted (CTA) message; otherwise, it sends back a Context Transfer Denied (CTD) message to the oldAR. If the feature context transfer request is accepted, the active feature contexts for the MN are transferred from the oldAR to the newAR. If, on the other hand, the feature context transfer request is denied, then the MN attempts to find another newAR as a new target for the context transfer.

[0026] Referring to the block diagram of Figure 1, the present invention will be described in detail. The system 4 for performing a feature context transfer between a pair of ARs (from an oldAR 6 to a newAR 8), includes a Main Contact Database (MCD) 24, a Memory Gateway (external) (MGE) 26, a Memory Gateway (local) (MGL) 22, a plurality of ARs 6, 8 and a plurality of MNs 28, (only one of which is shown in Figure 1 for simplicity).

[0027] It should be noted that although the system 4 shown in Figure 1 pertains to a single administrative domain, (i.e. of all the entities under the MCD 24), it would be understood by those of skill in the art, (as also shown in Figure 1) that there are connections to other ARs within the domain under the MGL 22, and also connections outside the domain via the MGE 26.

[0028] The MCD 24 is a database that contains the feature contexts for all MNs 28 being served in the domain. This includes the feature contexts for all active and inactive microflows. The MGE 26 is a control entity that provides an interface between different Memory Transfer Agents (MTA) belonging to different domains. The MGL 22 is a control entity that provides an interface between different local MTAs belonging to the same domain. The ARs 6, 8 are control units that provide an interface to the Internet Protocol

(IP) network. The ARs 6, 8 are responsible for assigning an IP address, (or any other type of address), to the MNs 28.

[0029] Each AR 6, 8 includes a Local Context Directory (LCD) 10, a Memory Transfer Agent (MTA) 12 and a Context Transfer Agent (CTA) 14. The LCD 10 maintains the list of feature contexts for active microflows for all MNs 28 associated with that particular AR 6, 8. The CTA 14 is a control entity that is responsible for establishing the contacts with the new point of attachment (i.e. the newAR 8) in order to transfer the active feature context to the newAR 8. The MTA 12 is a control entity that is responsible for transferring the context of the LCD 10 to the LCD 10 newAR 8.

[0030] The system 4 of the present invention utilizes selective transfer of feature context data. The feature contexts are separated into two categories: 1) feature contexts belonging to "active" microflows; and 2) feature contexts belonging to "inactive" microflows. As those of skill in the art would realize, an active microflow is one which is currently in progress sending traffic; whereas an inactive microflow is one which is suspended or stopped altogether. All the active feature contexts have to be available inside the LCD 10 of the AR (oldAR 6 and new AR 8), while the inactive feature contexts are stored in the MCD 24. Whenever a new microflow becomes active, its feature contexts are brought from the MCD 24 via the MGL 22 and loaded into the LCD 10, thereby overwriting any inactive feature contexts that may be present there. In accordance with the present invention, it is not necessary to store all of the feature contexts locally at the ARs 6, 8, it is only necessary to store locally the feature contexts of the active microflows. This helps to significantly reduce the size of the LCD 10 since the feature contexts for the inactive microflows can be accessed from the MCD 24 when needed. This also reduces the time required for the feature context transfer and also reduces the bandwidth and processing overhead.

[0031] The process of handover from the oldAR 6 to the newAR 8 initiates the feature context transfer process. To start the transfer of feature contexts, the MN 28 sends a "trigger" signal to the CTA 14 in the oldAR 6

through the wireless interface. This trigger signal may be in the form of a L2 trigger message, or it may be a separate IP packet.

[0032] This message is called Context Transfer Initiate (CTINIT). The CTINIT comprises an ICMP Echo Request message. The format of the CTINIT message is shown in Figure 2. A description of the terminology used in Figure 2 follows in Table 3:

FIELD	DESCRIPTION
TYPE	Echo Request- value 8
CODE	CTINIT - code value 1
CHECKSUM	The 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP Type. For computing the checksum, the checksum field is set to 0.
IDENTIFIER	unused, provided for future flexibility.
SEQUENCE NUMBER	unused, provided for future flexibility.
NUM ADDRS	The address of the prospective newAR.
ADDR ENTRY SIZE	The number of 32-bit words of information per each router address, (preferably 2).
LIFETIME	The maximum number of seconds that the AR addresses may be considered valid.
MN's IDENTITY	NAI or L2 address.
oldAR's IP ADDRESS	Current AR's IP address.
NewAR's IP ADDRESS	[i] Prospective target AR's IP address(es), (i = 1..NUM ADDRS):
Preference Level[i]	The preferability of each newAR[i] as i = 1..NUM ADDRS the candidate target AR, relative to other AR addresses in the same domain. A signed, two's-complement value; higher values mean more preferable.

TABLE 3

[0033] The CTINIT message provides a list of "target" newAR 8 along with their associated information. The associated information can change as desired by the system operator, but preferably comprises the fields shown in Figure 2. For example, the preference level is a value assigned to each AR in the domain. The preference level may be based on any criteria set by the operator, or may be made the same for all ARs. Preferably, the preference level for each AR in the domain is different, and the present inventon, will be

described as such. The oldAR 6 selects the newAR 8 with the highest preference value. However, if that newAR 8 denies the CTR request, the newAR 8 the next highest preference value is targeted.

[0034] After the MN 28 has transmitted the CTINIT message, it waits to receive back a Content Transfer Acknowledgement (CTACK) message. The CTACK message comprises an ICMP Echo Reply message. If no CTACK message is received within a timeout period, the MN 28 retransmits the CTINIT message. This is done repeatedly until either a CTACK is received, or a maximum count of retries has been reached, whereby the feature context transfer to that newAR 8 is abandoned and another newAR 8 is targeted. The format of a CTACK message is shown in Figure 3. A description of the terminology used in Figure 3 follows in Table 4:

FIELD	DESCRIPTION
TYPE	Echo Reply - code value 0
CODE	CTACK - code value 1
CHECKSUM	The 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP. For computing the checksum, the checksum field is set to 0.
IDENTIFIER	unused, provided for future flexibility.
SEQUENCE NUMBER	unused, provided for future flexibility.
MNs IDENTITY	(NAI or L2 address)

TABLE 4

[0035] No CODE value is currently used with the CTACK Echo Reply message. For the CTACK message, the MN's identity is echoed back to the MN 28, so that it can match it with the MN's identity previously sent with the CTINIT message.

[0036] After the CTINIT message is received, the CTA 14 in the oldAR 6 sends a Context Transfer Request (CTR) message to the CTA 14 of the newAR 8. Upon receiving the CTR message, the CTA 14 in the newAR 8 authenticates the oldAR 6.

[0037] Authentication ensures that the oldAR 6 is to be trusted and the information conveyed is correct. The authentication process is not central to the present invention and there are many such processes which are well known in the art that may be used. However one process for authentication is

done by establishing a Security Association (SA) between the oldAR 6 and the newAR 8. Each SA is given a number, known as a Security Parameters Index (SPI), through which it is identified. In order for the oldAR 6 and the newAR 8 to mutually authenticate themselves, the oldAR 6 must know the SPI value of the newAR 8. Likewise, the newAR 8 must know the SPI of the oldAR 6. The oldAR 6 sends its SPI value with the payload to the newAR 8, using a normal IP routing header. The newAR 8 verifies the SA by noting the SPI, and sends back a CTA if the context transfer request is accepted. When sending the CTA message, the newAR 8 also forwards its SPI value to the oldAR 6. Thus, in a similar manner, the oldAR 6 verifies the SA by noting the SPI value of the newAR6.

[0038] The newAR 8 sends back a Context Transfer Accepted message (CTA) if the CTR is accepted, or a Context Transfer Denied message (CTD) if the CTR is denied. If the CTR is accepted, then the feature context transfer can proceed normally, otherwise the context transfer is not permitted to proceed to that particular newAR 8.

[0039] The message formats for the CTR, CTA are also ICMP messages. CTR is an ICMP Echo Request, while CTA and CTD comprise ICMP Echo Reply. The format of the ICMP message for the CTR, CTA and CTD messages is shown in Figure 4. A description of the terminology shown in Figure 4 follows in Table 5:

FIELD	DESCRIPTION
TYPE	8 - Echo Request, 0 - Echo Reply
CODE	2 - CTR, 2- CTA, 3 - CTD
CHECKSUM	The 16-bit one's complement of the one's complement sum of the ICMP message, starting with the ICMP TYPE. For computing the checksum, the checksum field is set to 0.
IDENTIFIER	used for matching CTRs from sending.
SEQUENCE NUMBER	AR with CTAs or CTDs from receiving AR.
MN's ADDRESS	Provided in CTR message only. This field is absent in CTA and CTD messages.

TABLE 5

[0040] When the CTR is accepted, and the CTA message is sent back to the oldAR 6, the transfer of all active feature contexts for the particular MN 28 from the LCD 10 in the oldAR 6 to the LCD 10 in the newAR 8 is performed. This transfer may be accomplished using any of the data transfer and handshaking protocols that one known in the art to transfer data between two entities. Several messages are exchanged between the two ARs 6, 8 in accordance to insure connectivity and authenticity as well as the information being transferred.

[0041] Preferably the active feature contexts of the MN 28 that are resident in the LCD 10 of the oldAR 6 are transferred from the oldAR 6 to the LCD 10 of newAR 8 in an ESP encapsulated IP datagram. The innermost IP datagram contains a common IP header, and following that is a set of feature context objects. The basic structure of this datagram is shown in Figure 5.

[0042] The format of a CT object is shown in Figure 6. The basic structure comprises a CT header and a listing of the feature context parameters. A description of the terminology used in Figure 6 follows in Table 6:

FIELD	DESCRIPTION
TYPE	The type of feature context being transferred, (i.e. whether it's RSVP, iffServ, RoHc, AAA keys, etc.) The type value is unique to the specific type of feature context being transferred.
CODE	Within each TYPE, a number of different objects may be defined. For example, RSVP defines SENDER_TSPEC, ADSPEC and FLOWSPEC objects; DiffServ defines DSCP's to emulate PHB's in a Differentiated Services network; AAA registration keys. Thus, parameters are grouped into different sets, as indicated by the CODE values. Each particular set of parameters within a given class, is transmitted from the sending AR to the receiving AR as a separate CT object.
RES	unused, provided for future flexibility.
L	Last object transmitted. If a CT object with the L-bit set is not received within a timeout

	period, a suitable NAK message is sent to the sending AR. Also, if a CT object follows the CT object with the L-bit set, a similar NAK message is sent to the sending AR, indicating an error.
SEQUENCE NUMBER	Used for maintaining the order of transmissions of CT objects, and also for reliability purposes. If a gap in sequence number occurs, a NAK packet is sent to the sending AR, indicating the sequence number of the object that was not received.
NUM PARAMS	Number of feature context parameters transferred in this object.
LIFETIME	The maximum number of seconds that the context transfer object may be considered valid.
CHECKSUM	The 16-bit one's complement of the one's complement sum of the CT object, starting with the ICMP Type. For computing the checksum, the Checksum field is set to 0.
MN's IDENTITY	MN's NAI or L2 identifier.
PARAMETER(S)	List of feature context parameters.

TABLE 6

[0043] It should be noted that all context transfer messages between the oldAR 6 and newAR 8 are encapsulated with IPsec ESP, to handle security of data. During the establishment of sessions between the ARs, the CTR, CTA or CTD messages are represented by ICMP packets and placed in the datagram portion of the IP packet. Any feature context to be transferred between the ARs 6,8 are likewise encapsulated in standardized objects and placed in the datagram portion of the IP packet. A TCP header, ESP header and ESP trailer segments are added as shown in Figure 7. The resulting packet is then encrypted, to preserve the privacy and integrity of its contents. An ESP authentication field is added to end of the encrypted packet, and an IPv4 routing header is added to the beginning of the packet. The routing header must be the same as the innermost IP header.

[0044] The reliability of context transfer signaling messages, (CTINIT, CTACK, CTR, CTA and CTD), is provided by the 16-bit checksum in the ICMP header. The checksum is recomputed by the newAR 8, and the resulting value is compare with the value in the checksum field of the message. Any mismatch is flagged as an error, and a NAK is returned indicating the

SEQUENCE NUMBER of the erroneous message in the IDENTIFIER field. The original message is then retransmitted by the original sender.

[0045] Another source of error may be due to mismatch in the actual and computed checksum in the CT object header. If this occurs, a NAK is sent to the oldAR 6, indicating the SEQUENCE NUMBER of the erroneous CT object in the IDENTIFIER field. The NAK may be piggybacked onto another message, or sent as a separate message altogether. The resulting CT object is retransmitted as part of the same context transfer message, or as a new context transfer message.

[0046] When a new feature context is desired, a signal called Feature Context Request (FCR) is issued by the CTA 14. This message may be in the form of an ICMP datagram, including appropriate TYPE, CODE values and the identity of the MN 28. On receiving the FCR message, the MTA 14 may choose to accept (FCA) or deny (FCD) the request. These two messages may also be in the form of an ICMP datagram. The FCR may be accepted if there is sufficient space in the LCD 10 to store all the parameters associated with the feature context. If the FCR is accepted, the feature context parameters are brought from the MCD 24 into the LCD 10 in the newAR 8.

[0047] Referring to Figure 8, a procedure 100 in accordance with the present invention is shown. The procedure 100 transfers active feature context from an oldAR 6 to a newAR 8. The procedure 100 starts with all feature contexts (both active and inactive) being stored at the MCD 24, but only active feature context being stored at the oldAR 6 (step 102). Once handover is initiated, a retry parameter is initialized (step 104). The retry parameter keeps track of the number of retries the MN 28 has made in order to send the CTACK message. The MN 28 sends the CTINIT message to the oldAR 6 (step 106) and awaits a CTACK message (step 108). The MN 28 determines whether it has received a CTACK message (step 110). If the MN 28 has not received a CTACK message then the MN determines whether a timeout period has expired (step 112). If the timeout period has not expired, the MN 28 returns to step 108 to await the CTACK message. If the timeout period has expired, the retry parameter is increased by 1 (step 114) and the

MN 28 determines whether the maximum number of retries has been reached (step 116). If the maximum number o f retries has not been reached the MN 28 returns to step 106 and resends the CTINIT message. If the maximum number of retries has been reached, the feature context transfer to that newAR 8 is abandoned and another newAR 8 may be targeted (step 118).

[0048] Once the MN 28 determines that it has received a CTACK message as determined at step 110, the CTA 14 in the oldAR 6 sends a CTR message to the CTA 14 in the newAR 8 (step 120). The CTA 14 in the new AR 8 authenticates the oldAR 6 (step 122) and the CTA 14 in the newAR 8 sends back to the CTA 14 in the oldAR 8 a CTA message if accepted, and sends back a CTD message if denied (step 124).

[0049] If a CTA message has been received by the MN 28 (step 126), only the active feature context are transferred from the oldAR 6 to the newAR 8. If the CTA message has not been received by the MN 28 as determined at step 126, step 118 is entered whereby a different newAR 8 is targeted for context transfer.

[0050] Although the present invention is directed to a feature context transfer protocol for context transfers between an oldAR 6 and a newAR 8 within the same domain, it should be understood by those of skill in the art that in the event an MN 28 handoffs to a newAR in a different administrative domain, the process of transferring feature contexts between the LCDs 10 is also the same as hereinbefore described. However, in addition to the transfer of the active feature contexts between the LCDs, the inactive feature contexts are moved as well, from the current MCD 24 to a new MCD in the new domain. The MCD 24 transfer is accomplished via the MGE 26.

* * *

CLAIMS

What is claimed is:

1. A communication domain having a central node coupled with at least a first access router (AR) and a second AR, each of said ARs being in wireless communication with at least one mobile node (MN) via at least one active microflow, the communication domain including a system for transferring an MN from said first AR to said second AR in the event of a handover, the system comprising:

a central database at said central node for storing feature contexts for all microflows in the communication domain, said feature contexts comprising active feature contexts for active microflows and inactive feature contexts for inactive microflows;

a local database at each AR, each local database for storing active feature contexts for each active microflow to a NM; and

a memory transfer agent at each AR, for handling the transfer of only said active feature contexts are from said first AR to said second AR in the event of a handover.

2. The system of claim 1, whereby inactive feature contexts may also be stored in each said local database.

3. The system of claim 2 whereby said forwarded active feature contexts overwrite inactive feature contexts.

4. The system of claim 1, further comprising a context transfer agent (CTA) at each AR, for determining whether said forwarding of said active feature contexts may proceed.

5. A method for transferring context data from a first access router (AR) to a second AR upon handover within a domain containing a plurality of ARs, said first and second ARs being coupled to a central node, and said first

AR being wirelessly coupled to a mobile node (MN), said wireless coupling including an active microflow, the method comprising:

storing all feature contexts related to all microflows within the domain at the central node;

storing active feature contexts related to said active microflow at said first AR; and

initiating handover to said second AR, including forwarding said active feature contexts to said second AR.

6. A communication system having a central node coupled with a plurality of access routers (ARs), each being in wireless communication with at least one mobile node (MN) via at least one active microflow, the communication domain including a system for transferring an MN from said first AR to said second AR, the system comprising:

a central database at said central node for storing feature contexts for all microflows in the communication domain, said feature contexts comprising active feature contexts for active microflows and inactive feature contexts for inactive microflows;

a local database at each AR for storing only active feature contexts for each active microflow; and

a memory transfer agent at each AR, for handling the transfer of only said active feature contexts are from a first AR to a second AR.

7. The system of claim 1, whereby inactive feature contexts may also be stored in each said local database, and said forwarded active feature contexts overwrite inactive feature contexts.

8. The system of claim 1, further comprising a context transfer agent (CTA) at each AR for forwarding said active feature contexts.

9. A method for transferring context data from a first access router (AR) to a second AR upon handover within a domain containing a plurality of

ARs, said first and second ARs being coupled to a central node, and each AR being wirelessly coupled to a mobile node (MN) via an active microflow, the method comprising:

storing all feature contexts related to all microflows within the domain at the central node;

storing active feature contexts related to an active microflow at said first AR; and

forwarding only said active feature context from said first AR to said second AR.

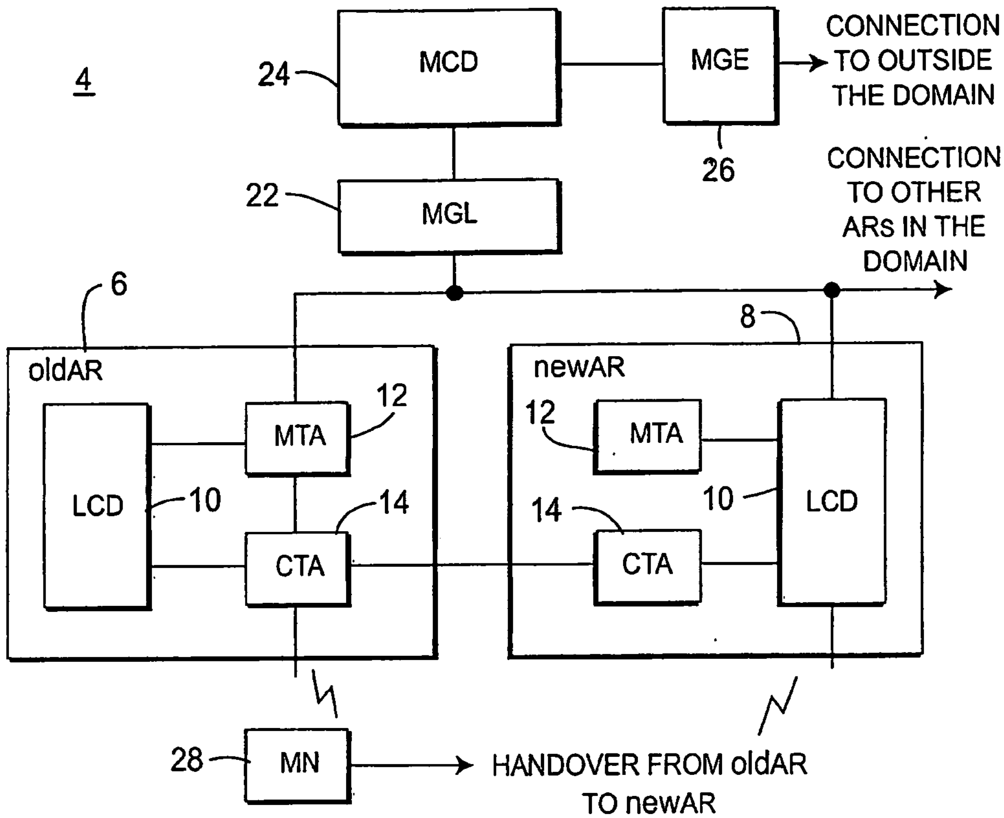


FIG. 1

TYPE	CODE	CHECKSUM
IDENTIFIER		SEQUENCE NUMBER
NUM ADDRS	ADDR ENTRY SIZE	LIFETIME
MN'S IDENTITY (NAI OR L2 ADDRESS)		
oldAR'S IP ADDRESS		
newAR'S IP ADDRESS [1]		
PREFERENCE LEVEL [1]		
newAR'S IP ADDRESS [2]		
PREFERENCE LEVEL [2]		
• • •		

FIG. 2

TYPE	CODE	CHECKSUM
IDENTIFIER		SEQUENCE NUMBER
MN'S IDENTITY (NAI OR L2 ADDRESS)		

FIG. 3

TYPE	CODE	CHECKSUM
IDENTIFIER		SEQUENCE NUMBER
MN'S ADDRESS (OPTIONAL)		

FIG. 4

IP HEADER
CT OBJECT 1
CT OBJECT 2
⋮
CT OBJECT N

FIG. 5

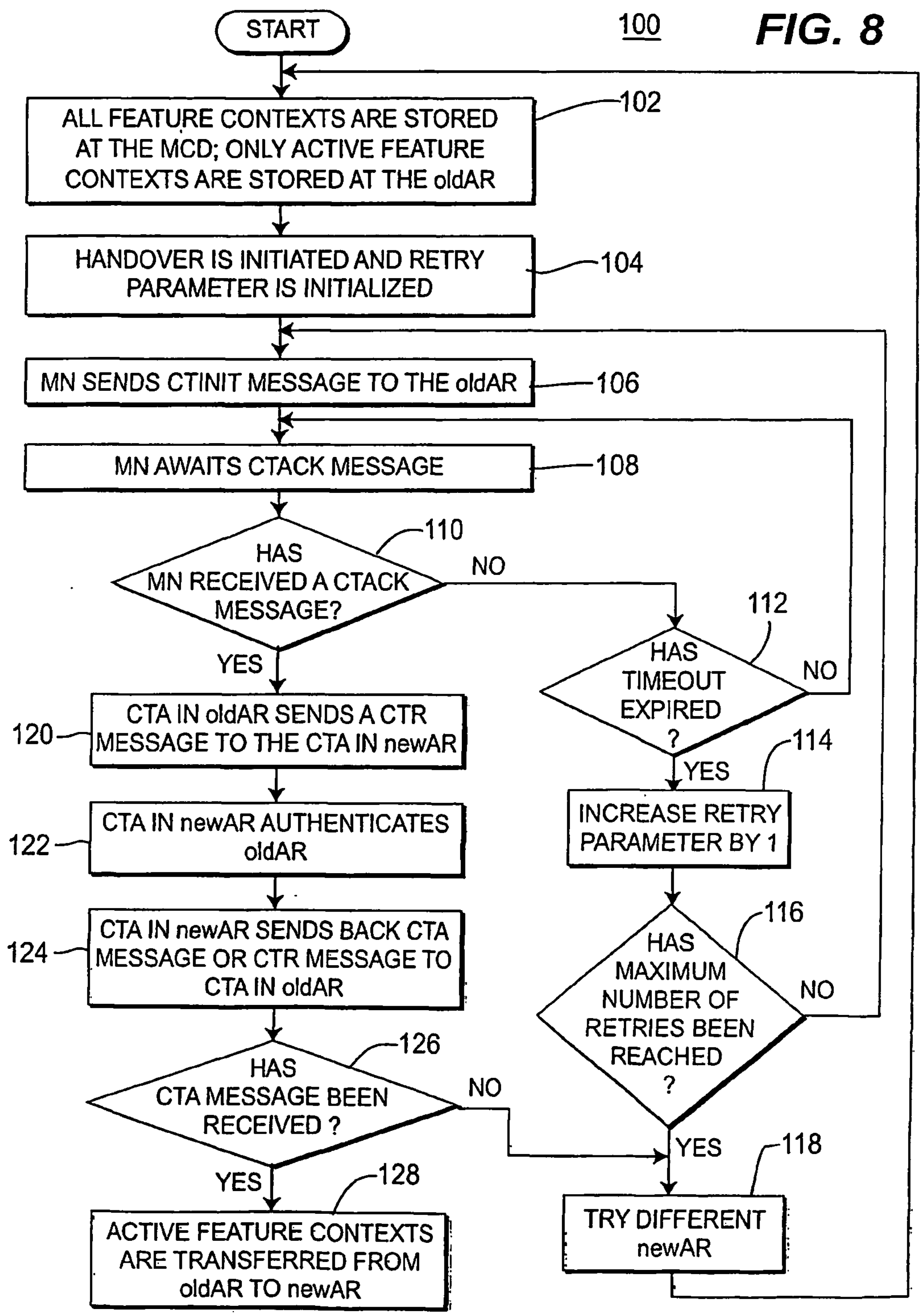
TYPE	CODE	RES	L	SEQUENCE NUMBER
NUM PARAMS	LIFETIME		CHECKSUM	
MN'S IDENTITY				
PARAMETER				
PARAMETER				
. . . .				

FIG. 6

IP HEADER
ESP HEADER
TCP HEADER
ICMP OR CT HEADER
FEATURE CONTEXT OBJECTS (OPTIONAL)
AUTHENTICATION FIELD

FIG. 7

FIG. 8


START
100
ALL FEATURE CONTEXTS ARE STORED AT THE MCD; ONLY ACTIVE FEATURE CONTEXTS ARE STORED AT THE oldAR
102
HANDOVER IS INITIATED AND RETRY PARAMETER IS INITIALIZED
104
MN SENDS CTINIT MESSAGE TO THE oldAR
106
MN AWAITS CTACK MESSAGE
108
HAS MN RECEIVED A CTACK MESSAGE?
110
NO
YES
HAS TIMEOUT EXPIRED ?
112
NO
YES
INCREASE RETRY PARAMETER BY 1
114
HAS MAXIMUM NUMBER OF RETRIES BEEN REACHED ?
116
NO
YES
TRY DIFFERENT newAR
118
CTA IN oldAR SENDS A CTR MESSAGE TO THE CTA IN newAR
120
CTA IN newAR AUTHENTICATES oldAR
122
CTA IN newAR SENDS BACK CTA MESSAGE OR CTR MESSAGE TO CTA IN oldAR
124
HAS CTA MESSAGE BEEN RECEIVED ?
126
NO
YES
ACTIVE FEATURE CONTEXTS ARE TRANSFERRED FROM oldAR TO newAR
128

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/39905

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04B 7/00; H04Q 7/00; H04L 12/28

US CL : 370/310.2, 328, 331, 351

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/310.2, 328, 331, 351

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Please See Continuation Sheet

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,320,873 B1 (NEVO et al.) 20 NOVEMBER 2001, (Figs. 2 and 5)	1-9
A	US 5,903,559 A (ACHARYA et al.) 11 MAY 1999, (Figs. 11-14)	1-9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

18 March 2003 (18.03.2003)

Date of mailing of the international search report

28 MAR 2003

Name and mailing address of the ISA/US

Commissioner of Patents and Trademarks
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Form PCT/ISA/210 (second sheet) (July 1998)

Continuation of B. FIELDS SEARCHED Item 3:
East, search terms: router, mobile, wireless, handover, handoff, QoS, DiffServ, Flow label, PHB, RSVP, database, memory, stored, IPv4 IPv6